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MAY 2002

**REPORT OF THE
CALIFORNIA HARBOR SEAL
ABUNDANCE WORKSHOP
MARCH 28-29, 2002
SOUTHWEST FISHERIES SCIENCE CENTER**

by

Jay Barlow

ADMINISTRATIVE REPORT LJ-02-04

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Report of the California Harbor Seal Abundance Workshop

March 28-29, 2002

Southwest Fisheries Science Center

Jay Barlow

Introduction

A workshop of harbor seal researchers was convened at the Southwest Fisheries Science Center on 28-29 March 2002. The intent of the co-conveners (Jay Barlow, NMFS-SWFSC and Dale Sweetnam, CDFG) was to bring together experts who could make recommendations about the timing and methods that should be used for a state-wide survey of harbor seals in California. The agenda for this meeting is given in Appendix 1. A list of the participants is given in Appendix 2.

Jay Barlow gave a brief introduction that included terms of reference for the meeting. He reviewed the Marine Mammal Protection Act (MMPA) stock assessment requirements and stressed the need for a minimum estimate of abundance (N_{min}) for the California stock of harbor seals. The last complete survey that produced a valid N_{min} estimate was in 1995. A survey in 2001 produced a count of hauled-out harbor seals, however, there is concern that the 2001 survey may have been too early to be comparable to previous counts. Barlow also stressed the value of measuring trends in harbor seal abundance to determine population status relative to a level known as Optimal Sustainable Population (OPS under the MMPA) and as a means for detecting human impacts that might otherwise go undetected.

Past Aerial Survey Efforts

California Harbor Seals

Dale Sweetnam and Bob Read (both of CDFG) reviewed previous surveys conducted by their agency. Methods of surveying harbor seals in California were initially investigated by Dan Miller and were further refined and carried out by Doyle Hanan (both now retired from CDFG). The method used since 1984 was to fly the coastline at 600-700' altitude in a Partenavia P68 twin-engine aircraft and to photograph all hauled-out harbor seals. Near-vertical photos were taken with a Hasselblad camera and a 100mm lens using 2 1/4" format color transparency film (ASA 100) through a large belly port in this aircraft. The surveys were flown in May-July, with earlier flights at the Channel Islands. Flight times were scheduled within +/- 2 hours from a mid-day low tide and were flown from south to north, to follow the progression of the tide. Photographic images of harbor seals were independently counted later by two biologists, and the two counts were averaged. Relatively complete surveys of the mainland were carried out each year from 1982-95. Surveys of the Channel Islands were carried out from 1984-95. Only a mainland survey was conducted in 1996, but counts from the photographs were not completed. After a lapse of 2 years (1997-98), surveys were attempted again each year 1999-2001. The 1999 survey was not successful due to a camera failure. The 2000 survey obtained a good count of the Channel Islands, but foggy weather prevented survey along much of the mainland. To avoid weather problems, the 2001 survey was scheduled for an earlier date and nearly complete coverage of the state was obtained. However, the 2001 count

was approximately half of the expected number for both the Channel Islands and the mainland coast. The number of occupied sites decreased in 2001 and, to a lesser extent, so did the average number of seals per site.

It is not known whether the low counts obtained in 2001 were the result of a real population decline, the earlier survey date, or some other factor that might have influenced the fraction of hauled-out seals at the time of the survey. The 2001 survey at the Channel Islands was flown on May 1-3 (compared to 1984-96 surveys flown between May 10 and July 1) and the 2001 survey of the mainland coast was May 14-17 (compared to the 1982-96 surveys flown between May 28 and July 13). In discussions, some participants believed that the early survey dates could have been responsible for the low counts in 2001. Counts at other locations have shown harbor seal numbers to be stable or increasing over the last 3-5 years, and nothing else unusual was noted about ground counts in 2001 that could explain the low aerial count.

Oregon Harbor Seals

Robin Brown gave a summary of the aerial survey methods used by Oregon's Department of Fish and Wildlife. State-wide surveys in Oregon are scheduled around the peak pupping season, either the last low-tide period in May or the first low-tide period in June. [Note that although the survey months are similar in California, the CA surveys coincide with the peak molting period in southern California and are well after the peak pupping season there.] Similar photographic survey methods are used, but photos are taken with a 35mm Nikon camera with a 70-210mm lens and are taken obliquely out of a side window. The aircraft is usually a smaller, single-engine Cessna 185, but a Partenavia is used in some years. A faster color transparency film (400 ASA) is used. The survey window of acceptable minus tides is approximately 4-6 days long, and within a day the window of acceptable tides is approximately 4 hours long. Extreme low tides are avoided, especially on weekends, because clam collectors frequently disturb hauled-out seals. Two complete replicate surveys are attempted. In 1984-85, monthly surveys were flown. In Oregon, the peak molt period is July to September, and in some areas, a dip in harbor seal haul-out numbers is seen in late June (between pupping and molting peaks). A cline is seen in peak pupping dates from southern Oregon to northern Washington.

Annual counts in Oregon increased during the 1980s to a peak near 1992. Counts since 1992 might be showing a slight decline.

Washington Harbor Seals

Steve Jeffries presented the methods of aerial harbor seal survey used by the Washington Department of Fish and Wildlife. Those methods are very similar to those used in Oregon and only the differences are described here. Aircraft used in the census are high-wing Cessna 185's or Beavers. Survey altitude is 600-800' (with the higher of this range being used with the noisier Beavers). Flights are scheduled between 8am and 2pm and at tide levels of +1 ft to -1 ft. The coast is divided into two regions: the outer coast and inland waters of Puget Sound, and 2-3 days are allocated to surveys in each region. Surveys are flown at a later date in Puget Sound (July?) to coincide with the later peak in pupping times.

Jeffries also described the radio-tagging method used to estimate the fraction of the population hauled out during aerial surveys in both Oregon and Washington. 124 harbor seals were

captured and tagged prior to the surveys in 1991-92. Radio tags (mounted on cattle ear tags) were affixed to their rear flippers. Radio frequencies were monitored from the aircraft during the survey to estimate the fraction of seals that were ashore during peak pup count. The results (Huber et al. 2001) showed that an estimated 54-74% of seals were ashore during the surveys; hence, peak haul-out counts could be multiplied by an average of 1.53 to give total populations size.

California's Other Pinnipeds

Mark Lowry (NMFS-SWFSC) described methods that he uses to count California sea lions, Steller sea lions, and northern elephant seals in California and Mexico. The primary difference is in his use of large-format aerial reconnaissance cameras (military surplus KA-45 and KA-72). These cameras use 5" wide film which is moved in the camera at the same rate as the image is moving, to obtain very high resolution images. Photographs are taken vertically from either the belly port in Partenavia P68 aircraft (in California) or from cameras mounted below a Hughes 500D helicopter (in Mexico). The cameras are set to take a sequence of consecutive photographs of ground images, with 67% overlap between adjacent frames. Images of pinnipeds are counted on a light table through a dissecting microscope. Images are marked on a sheet of clear acetate, and this sheet is moved between overlapping images to ensure all individuals are counted only once. Images are sufficiently clear to resolve dark sea lion pups on dark rocky substrate and, in most cases, to discriminate between live and dead pups.

California Ground-count Observations

Researchers at a variety of locations throughout California are collecting counts of hauled-out harbor seals. Unpublished data from many of these sources were presented at this workshop and are summarized briefly below.

Channel Islands

Counts have been made on the Channel Islands by Brent Stewart and Pam Yochem, and summaries are available in published papers (Stewart and Yochem 1984, 1994). In brief, the haul-out counts peaked in June on the Channel Islands. Daily peaks occurred in the afternoon. There was little effect of tide or weather on haul-out behavior. There was no evidence of a peak in numbers coincident with the peak pupping season (late Feb. - early Apr).

San Francisco and Monterey Bay

Jim Harvey presented a summary of work done in collaboration with others in central California. Figures were available from a joint report (with Dianne Kopec) on harbor seals in San Francisco Bay. No trend in S.F. Bay counts was seen for the period 1982-94, although some sites were up and others were down. Seasonal haul-out patterns varied tremendously between sites as did the proportion of females present. Radio telemetry studies were conducted in San Francisco Bay. Three aerial surveys are planned for the Bay in 2002 in studies related to airport expansion plans. In Monterey Bay, harbor seal counts are conducted at Elkhorn Slough, Santa Cruz, and the Monterey Peninsula. Harvey described harbor seal research conducted by graduate student Teri Nicholson on the Monterey Peninsula, where haulout counts peaked in December-January. Nicholson learned to recognize individual seals by eye and found that haul-out patterns varied among individuals. Haulout counts at this site increased with swell height. Harvey explained that this is a sheltered site

used more frequently when alternative sites are uninhabitable due to high swell conditions.

Point Reyes, San Francisco Bay, and Tomales Bay

Sarah Allen described her work and that of collaborators. They use the term "site" to refer to general areas and the term "sub-site" to refer to specific haul-outs. Counts at Point Reyes and Double Point were done by trained volunteers. Counts in San Francisco Bay were done by graduate students in studies of the impact of the Richmond-San Rafael Bridge retrofit. At Double Point, pup counts increased through 2001 (except in 1998, after El Nino). Outside of the Bay, pupping occurs from the second week of March through June, with peak numbers of pups present the first week in May. The peak molt period is late June and early July. A dip in numbers was seen between peak pupping and peak molt periods. Shifts in distribution are seen to sites that are favored for pupping and for molt during those time periods. Double Point appears to be a staging area for seals that travel to the Farallon Islands. Seals that were radio tagged in Drakes Estero moved as far as northern California and Monterey Bay.

Studies of harbor seal health were prompted by die-offs observed in 1997 (n=100) and in 2000 (n= 25). The cause of the die-offs is still being investigated. It was determined that all seals also carried brucellosis and herpes pathogens. Elephant seals are now showing up in greater numbers at sandy harbor seal haulout sites and are aggressively displacing harbor seals in some cases.

Farallon Islands

Bill Sydeman presented data from long time-series (1973-2001) of harbor seal counts at the Farallones made by Point Reyes Bird Observatory. The Farallones are used only as a haulout site for most seals and very few pups (1-5) are born there each year. Approximately weekly counts are made from atop the light house, and surge channels that cannot be seen from that vantage are surveyed on foot. Counts are typically made on Thursday afternoons, and thus are randomized with respect to tide level. Counts were increasing from 1973-83, were flat or slightly decreasing 1983-90, were increasing 1990-93, and were flat or slightly decreasing 1993-present. Mean monthly counts were relatively flat year-round, but generally showed a maximum in July. Maximum monthly counts showed a very similar pattern to mean counts.

Southern California Mainland

Christina Fahy (NMFS-SWR) summarized harbor seal count data from Vandenberg, Carpinteria, Pt. Mugu and La Jolla.

At Vandenberg Air Force Base (VAFB), counts are up 12.6% from 1997-2001, but did show an El Nino dip in 1998. Pup count has doubled since 1997 (21 pups in 1997, 42 pups in 2001). Peak pupping is in Mar-Apr, and the peak molt is in June. Counts are highest in the late afternoon and at tide levels of less than 0.5 feet. The main determinant of daily haulout behavior of seals at south VAFB is time of day rather than tidal height, with the highest number of seals hauling out between 11:00 am and 5:00 pm. The total number of harbor seals at VAFB is estimated to be 1,040 (775 on south VAFB and 265 on north VAFB).

Carpinteria is a semi-protected haulout with a beach-watch program. Since the seal watch group began counting seals in 1992, pup production has more than doubled (from 15-18 in 1992 to 49+ in 2002). Pupping season begins in late January, through April, with a peak in March. The beach is closed to the public from December 1 through May 31st – during this closure period, the peak numbers of animals haul out during low tide in the afternoon. During the non-closure period,

the peak numbers of animals haul out during low tide, early morning, when they are less disturbed by humans and dogs on the beach.

At Pt. Mugu lagoon harbor seals are counted between 11:30-12:30 every day. Peak ground counts at that site increased from 156 to 328 over the past decade (1992-2001). The peak haulout season (molt) is late May to early June.

The La Jolla haulout used to be limited to offshore rocks (Seal Rock Marine Mammal Reserve), but seals were first observed hauling out on an adjacent sandy beach (Children's Pool Beach) in the mid to late 1980s. Approximately 10 pups are born each year at this site in Feb-Apr, and the maximum count for both sites generally occurs in April. There is a dip in counts in May, and another peak count occurs in June. The maximum count at both sites in La Jolla is approximately 175 seals.

Northern California

Dawn Goley summarized her research and that of her students at Humboldt State University. She has enlisted the help of a Coast Guard helicopter crew to aid in doing a photographic aerial census of harbor seals. Flights are scheduled for each Monday afternoon, contingent on helicopter availability. She averages 2.8 samples per month. She uses 35mm cameras and shoots oblique images. Aerial photographic counts cover the mouths of the Smith, Klamath, Mad, and Eel Rivers and mud flats in north and south Humboldt Bay. Shore-based counts are also obtained for harbor seal haulouts in north and south Humboldt Bay approximately 10 times per month. Her data show that different sites showed widely varying seasonal patterns of haulout behavior. However, when all the sites are combined, a single distinct peak is evident between the 20th and 35th weeks of the year (mid-May to late-August) with the highest peak near the 30th week (late July). No effect of tides was seen at haulouts at river mouths, but tide had big effect on the mud-flat haulouts.

Sonoma County to San Francisco Bay

Joe Mortenson gave a summary of harbor seal research at San Mateo, San Francisco Bay, Point Reyes, South Sonoma County, and Sea Ranch haulouts. Coordinated counts by the Gulf of the Farallones National Marine Sanctuary, the Point Reyes National Seashore, the Richmond San Rafael Bridge Harbor Seal Survey, Seal Watch Jenner, and Seal Watch Sea Ranch were made from mid-April to July, typically at low tide or rising low tide around mid-day. Data were assembled and analyzed by the Farallones Marine Sanctuary Association. At the Jenner haulout (mouth of the Russian River) counts were made daily 1989-2002 by Elinor Twohy. At Bolinas Lagoon, four or more counts were made each month 1997-2001. At other sites, multiple counts were scheduled each month. During the pupping season, the proportion of pups in the total count ranged from 10% to 25% at different regions. Counts appear to be relatively flat from 1998-2001. Largest numbers were found at Point Reyes sites. Mortenson also made studies of animals in the water near haulout sites. Approximately 27-75% of seals at some smaller haulouts were in the water, but this fraction was lower at the Russian River (only 4%). He found that seals in the water spent only about 10% of their time at the surface (0.7 min up and 5.6 min down). At Jenner, there were peak counts observed in March, May, and July, and if the river mouth was open, counts were much greater.

Modelling Harbor Seal Haulout Behavior

Peter Boveng presented his new method for predicting the maximum number of harbor seals that would be expected to be hauled out under optimal conditions (Boveng et al., submitted). Its application was illustrated with harbor seal aerial count data from the Gulf of Alaska in 1996. The method is based on making 4-5 replicate counts under a variety of conditions. The region surveyed is so large that this requires 9 aircraft (each with one observer/photographer). Surveys are flown within 2 hours of low tide. Boveng uses Generalized Additive Models (GAMs) with a negative binomial error structure to model the effect of a number of factors on the number of hauled out seals. Factors he examined included date, time, relative tide height, relative tide time, wind speed, air temperature, and sky/precipitation. His final best model did not use temperature or relative tide time. His model predicted that highest counts would be at mid-day at the beginning of his survey period. The maximum predicted count from this model was approximately 1.8 times higher than the mean of all replicate counts. Boveng discussed concerns about the model's ability to estimate population size. For example, it is not known if all of the factors are truly additive or whether the predicted peak in abundance might represent some unfeasible combination of parameters.

Boveng also presented preliminary results from another paper that uses a similar approach to estimate the fraction of harbor seals missed during optimal survey condition. This is based on radio-tag data collected at two other sites in Alaska (Southeast Alaska and Bristol Bay). The presence/absence of radio-tagged seals during a survey is modeled using GAMs with a logistic error structure. Factors affecting the probability of a seal being hauled out were date, relative time, rainfall, solar time, minimum air temperature, and wind speed. The model predicted that at optimal haulout times, 81-86% of seals would be hauled out at these two sites. The correction factors to obtain total population size from haulout counts are approximately 1.2X. The combination of the above 1.8X correction factor (to adjust mean counts to peak counts) and this 1.2X correction factor (to adjust peak counts to actual abundance) is roughly 2.2X, which is larger than the correction factors for Oregon/Washington (1.5X) that were not corrected for optimum conditions. It is not known whether the total correction factor is greater at these Alaska site because of some difference in the biology or whether the Oregon/Washington surveys were better able to catch peak haulout periods.

Discussion Points

What is the optimal timing for a state-wide aerial survey?

Two times were discussed for the CA state-wide aerial survey of harbor seals: the pupping season and the peak molt season. In both Oregon and Washington annual surveys are conducted during the pupping season, in late-May or early-June. The main advantage, other than comparability with OR and WA, would be obtaining an estimate of the number of pups each year. Peak molt survey has the advantage of more closely maintaining comparability with past aerial surveys in California (mid-May to early July) and, in some locations such as the Channel Islands, there does not appear to be any peak in seal counts near the peak pupping time. Most participants felt that there would be an advantage to surveying both time periods. However, since timing is already too late to

plan a peak-pup count in 2002, discussion was focused on the optimal timing for a peak-molt survey in 2002.

The chronology of pupping and molting varies by a month or more from Southern California to Northern California (Table 1). Peak pupping ranges from March-April in the south to May-June in the north. Molting ranges from May-June in the south to June-Aug in the north. It was noted by several participants that molting occurs over a long time period with different age/sex classes molting at different times. The peak numbers hauled out appear to be nearer the beginning of molting season, late-May to early June in the south and July in the north. A dip in seal counts between pupping and molting was observed in several areas.

The workshop recommended that the timing of a peak-molt survey would have to be different in the southern and northern parts of California. They recommended a survey in late-May or early-June south of Pt. Sal or Pt. Sur (including mainland and Channel Island site), and they recommended a July survey in areas north of there. They recommended that in most areas other than the Channel Islands that the surveys be flown at low tides, typically when tide levels are less than 1 foot above mean low tide level. At the Channel Islands, time of day appeared to be more important than tide and afternoon counts were higher. To maximize the tide window, flights should be scheduled during periods of the month with lower tides. However, several participants cautioned that extreme low tides were also favored by clam diggers who disturb seals, and in those areas, weekends should especially be avoided. Several participants recommended to CDFG that alternative cameras be obtained that can handle faster film (ASA 400) so that the daylight hours with acceptable lighting and tides could be maximized.

Recommendations for future surveys included the addition of counts during the peak-pupping period (if funding permits), development of a system to record time, latitude and longitude automatically with each frame shot, acquisition of a new camera system, experimentation with infra-red film, and a state-wide radio-tagging effort designed to estimate the fraction of animals at sea during the annual survey period.

How can ground counts contribute to a state-wide aerial survey?

In the past (prior to 1996), several participants had been encouraged to make ground counts during aerial surveys. The value of these counts was discussed. In general, it was concluded that ground counts made specifically to coincide with aerial survey counts were not particularly useful. Typically, ground counts are less reliable than counts made from aerial photographs, so the concept of "ground-truthing" is not particularly appropriate. Although ground observations of disturbance might help explain why an aerial count at a particular site might have been low, this could not be done at a sufficient number of sites to be of much value in a state-wide survey.

In general, it was felt that ground counts could contribute most by helping to define the peak haulout periods and how harbor seal haulout behavior changes with season, solar time, tide, wind, swell, and other factors. Although this workshop provided a worthwhile first effort, the group expressed a desire to see data compiled by many people in many parts of the state be pooled together for an analysis of these factors on a larger scale. Such a meta-analysis might be able to show patterns

that would not be evident from studies at individual sites.

All participants expressed a desire to be kept informed of planned state-wide aerial survey dates and times.

Can harbor seal haulout behavior be modeled in order to “correct” off-peak counts?

The aerial survey of 2001 appears to have been too early to catch the peak number of harbor seals. Past aerial surveys in California occurred at various times relative to the peak haulout period and might also be biased to greater or lesser degrees. If the seasonal variation in haulout numbers was adequately known, the variance in annual count data that is caused by the timing of the survey could be reduced. All surveys could be “corrected” to the predicted number of seals that could be counted IF they had all been conducted at the peak time. A modeling of harbor seal haulout behavior (such as given in Boveng’s example) could form the basis for making such corrections.

Boveng’s method was, however, based on aerial surveys with multiple replicate counts taken over a relatively long time period during a single year. Such data are not available for California, and survey budgets have not been large enough to permit this approach with aerial surveys. The group expressed cautious optimism, however, that such an approach might be possible using ground count data to define the seasonal peak. It was noted in several presentations, however, that the seasonal peak in haulout numbers often varied widely between adjacent sites and that a large number of sites might be necessary to define the general regional patterns of haulout behavior. In this regard, it might be necessary to monitor seals on a number of adjacent haulouts that represent alternative sites used by individual seals in a region. A first step to evaluating the potential for this approach is to pool harbor seal ground-count data from researchers throughout the state.

Can trend-sites be used to monitor harbor seal populations in California?

The workshop attendees divided this question into two parts: monitoring harbor seal abundance from ground counts and monitoring demographic indices. Regarding the former, Jim Harvey noted that trend sites in Prince William Sound, Alaska were not adequate to evaluate the local effects of an oil spill. He emphasized that trend sites were not a suitable substitute for a state-wide survey effort. It was noted that trends in the abundance of seals at many sites did not mirror trends for the entire region, and that sites would have to be chosen carefully. It was recommended that all the alternative haulout sites in a given area should be considered a “trend site”. The group noted that ground counts were not the only method that could be used to monitor such “trend areas” and that aerial surveys along limited stretches of coastline might be a better method. Whatever method is used, it was agreed that sites should be chosen from throughout the state, all habitats and haulout sizes should be sampled representatively, and areas should be chosen to be large enough to accommodate movement. It was proposed that the time series of aerial counts made by CDFG could be used to answer the question of how many sites need to be monitored to represent the same state-wide trends that were observed from all sites combined. This sort of retrospective analysis could also be used to determine whether it is better to monitor many widely separated areas or whether a smaller number of areas should be monitored but a greater number of haulout sites within an area.

Research Topics

During discussions, the workshop group outlined several potential research topics. Workshop participants were asked to vote for the two projects what would have their highest priority. The topics, ranked by number of votes, are:

- 1) Compile all ground counts that have been collected by independent researchers throughout the state into a single data base to look for seasonal pattern of haulout behavior. (15 votes)
- 2) Conduct a state-wide radio-tag study in conjunction with a state-wide survey to determine the fraction of seals hauled out. (6 votes)
- 3) Conduct a retrospective analysis of previous CDFG aerial surveys to determine how best to use "trend sites" to accurately monitor harbor seal populations between aerial surveys (how many sites and how should they be distributed?). (6 votes)
- 4) Conduct a multi-variate analysis of the available ground-count data to determine the factors that are related to haulout behavior (season, time-of-day, tide, wind, etc). Use this model to correct previous state-wide counts made by CDFG to give the predicted number of seals hauled out at a standardized date. (4 votes)
- 5) Measure age-specific birth and death rates of harbor seals to create a harbor seal life table for the California population. (1 vote)
- 6) Monitor indices of harbor seal "condition" to determine the relative status of the population. (0 votes)
- 7) Determine the timing of molt for different age/sex classes (using direct observation of molted animals rather than inferring molt from haulout patterns). (0 votes)

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Table 1. Timing of pupping, molting, and peak-haulout times for harbor seals in various parts of the state of California.

Site	Pupping Season	Molting Season	Peak Haulout	Dip in counts between Pupping and Molt?	Years Observed	Maximum tide for a good count	Approximate Peak Numbers
San Diego	Mar to Apr	May to Jun	Jun-early July	N	1995-2001	?	<200
L.A. to Santa Barbara	late Feb to Apr	May to Jun	end-May to beg-June	Y	1992-2001	?	<500
Channel Islands	late Feb to Apr	May to Jun	end-May to beg-June	Y?	Early 80's	Time-of-day is important.	~4000
Point Conception	late Feb to Apr	May to Jun	end-May to beg-June	Y	1987-1994	<1.0'	~1100
Monterey	Apr to May	June to Aug	May to June	Y	1992-2001	<1.5'	1000-1500
San Francisco Bay	Apr to early-May	June to Aug	May to June	N	1989-2001	<1.0'	500-600
Pt. Reyes /Bolinas	late-Apr to early-May	late-June to Aug	early-July	Y	1976-2001	<1.0'	4000-5000
Islas Farallones	n/a	late-May to July	July	N?	1971-2001	-	<200
Sonoma Co.	Apr to May	June to July	Mar & May & July	Y	1987-2001	-	200-300
Humbolt Co.	mid-May to June	late-June to Aug	July	N	1998-2001	<0.5'	~2000

Appendix 1

Agenda: California Harbor Seal Abundance Workshop

March 28-29, 2002

Southwest Fisheries Science Center

Thursday 3/28/02

I. Introduction/Terms of Reference (Jay Barlow, NMFS-SWFSC)	0900
II. Past aerial survey efforts	
California (Doyle Hanan, Dale Sweetnam, Bob Read, CDFG)	0920
Oregon (Robin Brown, ODFW)	1000
Washington (Steve Jeffries, WDFW)	1020
<i>Coffee Break</i>	1040
Other CA pinnipeds (Mark Lowry, NMFS-SWFSC)	1100
III. CA Ground Counts: Temporal patterns of haulout behavior	
Monterey Bay (Jim Harvey, MLML)	1120
San Fran/Pt Reyes (Sarah Allen, NPS)	1140
<i>Lunch</i>	1200
Farallon Is. (Bill Sydeman, PRBO)	1400
So. CA (Tina Fahey, NMFS-SWR)	1420
Northern California (Dawn Goley)	1440
<i>Coffee Break</i>	1500
Sonoma County (Joe Mortenson, FMSA)	1520
IV. Modelling Haulout Behavior	
Alaska (Peter Boveng, NMML)	1540
V. Discussion: Temporal patterns of haulout: common patterns?	1600
<i>Adjourn</i>	1700

Friday 3/29/02

VI. Discussion: Optimal timing of state-wide survey.	0900
<i>Coffee Break</i>	1030
VII Discussion: Coordination of aerial and ground counts to improve state-wide survey.	1100
<i>Lunch</i>	1200
VIII Discussion: Monitoring trends in abundance	1300
IX. Wrap-up/Recommendations	1400
<i>Adjourn</i>	1500

Appendix II: List of participants at the CA Harbor Seal Workshop

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